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AGRICULTURAL EXPERIMENT STATION.

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BULLETIN NO. 80.

Progress of the Experiment Station Work.

The constant demand for information as to the progress made in the establishment and work of our experiment stations, under the Hatch Act, renders it expedient to publish at this time a succinct account of the progress made and of the plans now definitely adopted. It may be stated that these run entirely within the lines indicated in a former bulletin (No. 78), but as that document may not be in the hands or may have passed out of the memories of many interested, its main points are given here for information :

Experimental work of the exact character set forth in the "Hatch bill" has been carried on at the University of California since 1876; the first report of work done was issued early in 1877, and it has continued uninterruptedly ever since to such extent as the appropriations made from time to time by the Regents and the Legislature would permit. During the two financial years immediately preceding the present one the aggregate annual expenditure for experimental work has approached very nearly to the amount lately appropriated under the Hatch Act.

In several other States the State appropriations were withheld upon the passage of the Hatch Act, and the (subsequently discovered) failure of the latter to make an actual appropriation caused serious inconvenience in these cases and gave additional energy to the efforts, fortunately successful, to have the omission remedied by a special Act of Congress, which passed very early in the present session. Since this supplementary Act, however, left the provisions of the Hatch Act unchanged, it became necessary to expend within practically four months' time, and yet within the limits of the law, the full amount of the annual appropriation of \$15,000, since any unexpended balance would be forfeited.

In California no withdrawal of the State aid from the experimental work occurred or was intended, it being understood that the work would be carried on as before but without spe-

cial appropriations being asked therefor; and that, in the event of the passage of the Hatch Act, the funds thus made available would be used to increase the scope and efficiency of the experimental work; and, notably, that "Culture Experiment Stations" should be established in the various climatic divisions of the State, so far as the means at command would permit. This course was in accord with the expressed desire of the State Grange and other representative agricultural bodies, whose influence was exerted in behalf of the passage of the Hatch Act.

In pursuance of a report and recommendations on the subject addressed by the undersigned to the President of the University early in March, 1888 (Bulletin No. 78), the Board of Regents promptly authorized him to take immediate steps toward the establishment of the long-contemplated outlying stations.

The following extracts from the bulletin just referred to give, in brief, the points of view taken in the premises:

"In determining the proper location of the outlying stations, their distinctive objects, and relation to the central station at Berkeley, should be kept clearly in view. The latter must of necessity cover the whole ground of investigation in agricultural science and practice, as recited in the Act of Congress and as heretofore carried out so far as the means at command permitted. The outlying stations, on the contrary, are designed to be essentially 'culture stations' only, in which the adaptations of culture plants to the local climates and soils are to be tested systematically, in order to relieve the practical farmer from the necessity of making such trials at his individual and often very heavy expense in unproductive investments, and the results of which, after all, are not convincing to others and do not become part of public experience.

With this object in view it is evident that in the selection of locations for such stations the following points should be primarily regarded:

1. Each station should be representative of as large an area of agricultural land as possible, with respect to climatic conditions first of all, and secondly with respect to soil conditions.

2. Agricultural regions of which the adaptations and peculiarities are still uncertain should receive attention first, since it is here that the greatest volume of work remains to be done; while in regions that have been settled up long ago, the trials of individual culture plants that may come into question may be intrusted to intelligent individuals.

This implies, conversely, that when, after a time which may vary from 10 to 20 or more years, a culture station shall have fulfilled its main objects, it may be dispensed with, or transferred to another locality standing in need of such work. Yet it may also turn out to be desirable to maintain some outlying station or stations permanently, and invest them with additional functions in the prosecution of agricultural experimentation. Under this point of view it would seem to be desirable that the lands occupied should be held in trust, or on lease, rather than in fee simple, by the University.*

It is my impression that such tenure of land for the purposes of a culture station can in most, if not in all cases, be obtained by consent or donation from the owner, with only nominal expense to the institution.

As regards the necessary buildings, the Act provides that a sum not exceeding \$3000 may be expended for buildings and repairs, the first (this) year; but thereafter only \$750 per year shall be so applicable. This provision was evidently intended to prevent the improper use of the fund for extensive buildings, allowing only what is considered absolutely essential, such as dwellings for employees, barn, tool and propagating house, to be defrayed out of the appropriation. This works well enough where, as in the smaller Eastern States, one single station answers all purposes. But where, as in California, at least five stations (besides the central one at Berkeley) will be required to represent even remotely the several agricultural regions, this provision leaves us without the means of providing for their buildings.

From the offers and suggestions already received, I believe that this difficulty can be overcome by inviting subscriptions to defray the cost of needed buildings, in the localities or regions that will be benefited by their establishment. It would manifestly be invidious to allot the whole \$3000 permitted by law to any one favored locality, unless it be the central station at Berkeley. The latter, as you are aware, stands in the most urgent need of buildings that shall properly subserve the uses of the Experiment Station, which at present has neither office, nor collection-room, nor adequate laboratory accommodations. In conformity with this view, I have already submitted to you suggestions and plans by which, supplementing the \$3000 with an appropriate sum from the University Fund, a satisfactory building for the use of the station may be constructed, mostly upon foundations already existing. This is really the first need for the successful management of the already complex work, which will become ad-

ditionally heavy and complicated when the outlying stations shall have been established.

As regards the number and general collocation of these culture stations, I have already, in former reports and communications, outlined my views in the premises. They are based upon the natural agricultural subdivisions of the State, which may be stated as follows:

1. Southern region, from San Diego to Santa Barbara, and inland to the Mojave and Colorado deserts.

2. San Joaquin valley, from the Tejon mountains to Stockton.

3. Sacramento valley, from Stockton northward.

4. Foothills of the Sierra, substantially from Fresno to Tehama county.

5. Coast Range region.

It is impossible to make fewer divisions, and consequently *five outlying culture stations* is the minimum number that can at all represent the State."

Shortly after the publication of Bulletin 78, tenders of land and of funds sufficient for the needed improvements were received from the following counties, in the order here named: Amador county, for the "Foothills station;" San Luis Obispo county, for the station representing the Southern Coast Range region; Tulare county, for the San Joaquin Valley station. Soon after several suggestions and one definite offer (the latter from Mr. F. A. Kimball of National City) were also received from the Southern region. But a discussion of the time and funds at command led to the conclusion that it would be unsafe to involve ourselves in the establishment of more than three stations during the first year, and until experience should have yielded some more definite data in respect to the first cost and running expenses of such establishments. Moreover, the shortness of the time before the expiration of the financial year (June 30th) would render a full investigation of a larger number of localities as to their fitness, physically impracticable.

In each of the above counties, the choice between several tracts was given. Each of these was personally examined by the writer, two visits to each county being made, and the final choice was based upon the current consideration of the points mooted in Bulletin 78, with that of convenient location and willingness of residents to give financial or other aid. A full account of these points would be too lengthy for the present publication, and is reserved for the annual report; but the subjoined summary statement regarding the establishment of and progress thus far made in the several stations (named in the order of their acceptance) will convey the information now called for.

1. *The Foothill Station.*—This station was established first, under the enthusiastic and efficient initiative of Senator A. Caminetti of Jackson, Amador county. After much consideration of the respective merits of hills and valleys in the premises, the choice fell upon a tract situated about $4\frac{1}{2}$ miles a little east of north of the town of Jackson, the county seat. According to the levelings of the Amador ditch, which passes through it, and a topographical survey made by a volunteer party of University students, its highest point is 200 feet above the ditch, which itself is there at about 1850 feet elevation; making the average height above the

*A tenure in fee simple, but with reversionary clause for the case of the station being abandoned, has been subsequently adopted by the Regents.

sea about 2000 feet. This, according to the best testimony available, is the height at which frosts are least liable to injure delicate fruits, including the Citrus tribe; and the tract possesses the special advantage of including within its limits three of the most important soils of the foothills region, viz., the red "slate" soil, the granite soil, and the quartz gravel soil. Its natural vegetation embraces a very full assortment of the trees and shrubs of the lower "foothills," including the Buckeye and Toyon. The main tract of 22 acres was donated by Senator John Boggs of Colusa. But as this lacked a representation of certain desirable features of soil and exposure, an addition of six acres was made on the west, by a donation from Mr. McKay, and a tract of seven acres was added on the north by Messrs. Trabucco and Oneto, compensation being made them for the large standing timber.

The improvement of the tract was carried out on a very liberal scale by a committee of citizens. A new road was graded $1\frac{1}{2}$ miles up to the land from the county road. The main tract was fenced with a board-and-wire fence, also grubbed and plowed. Pipes for water supply were laid from the ditch both to the central hill on which a reservoir for irrigation is located, and to the higher hill upon which the dwelling is to be placed, and from whence it will command a wide view among the mountains and over the Sacramento valley, and as far as Mr. Diablo. The two-story dwelling with glass propagating-house, as well as stable and tool-house, are now in progress of construction, in general accordance with plans furnished by the University.

The two exterior tracts have been fenced, and the reservoir of 25,000 gallons capacity constructed, at the expense of the station fund; a water-power and pump will be placed in the ditch by consent of the Ditch Company, who also liberally agree to supply gratuitously the needed water. It is, however, intended to use irrigation as sparingly as possible, in order to prove what can be done without it in the foothill region.

2. The station for the *Southern Coast Range* has been established under the initiative of J. V. Webster, Esq., of Creston, San Luis Obispo county, and is intended to represent the largest interior valley of the Coast Range, drained by the Salinas river. In its lower portion the valley of the Salinas, three to four miles wide, is open to the coast winds, which control its climate. Above Soledad it gradually contracts and ascends considerably, being for some distance not much wider than the shallow, sandy river-bed, although not flanked by high mountains. Above San Miguel the valley again expands, and finally broadens out into a level or slightly undulating country, traversed by the upper tributaries of the Salinas, chief among which are the Huer-Huero and Estrella. From the latter stream the whole region, picturesquely dotted with oak groves that give it a park-like appearance, is often designated as "the Estrella Plains," although that designation belongs properly to the more restricted and partly timberless area immediately adjoining Estrella creek itself. From above Templeton (the present railroad terminus) to San Miguel its length is about 20 miles, while from the Salinas, near Paso Robles,

eastward to the Cholame range its greatest width is about 14 miles. As within these limits there is scarcely any waste land, and the soil when well cultivated is very productive without irrigation, this region constitutes one of the largest continuous areas of agricultural land in the State, outside of the Great Valley. As yet it is but thinly settled and its productive capacity imperfectly understood, hence it is eminently worthy of being made the subject of exhaustive culture experiments.

From among several desirable locations offered in this region, a tract of 20 acres situated within two miles of Paso Robles, on the plateau, about three-fourths of a mile east of the Salinas river, and 80 feet above it, and offered by Mr. J. V. Webster, was finally accepted. A subscription toward the erection of the necessary buildings was raised by Mr. Webster, chiefly among the citizens of Paso Robles and Templeton, and neighborhood.

The tract is a parallelogram $1700 \times 512\frac{1}{2}$ feet, and fronts on the new public road from Paso Robles to the Huer-Huero settlements. Like the foothill station, it contains representations of three of the most important soils of the region; and the larger part of it (having the light, sandy soil of the plains) was quite heavily timbered with the prevalent "blue oak" (*Quercus Douglasii*), here mostly not distinguished from the white oak (*Q. lobata*), which occupies only the lower ground. This timber has (with the exception of a few fine trees) been grubbed out, the stumps cut off and taken from the holes, and the latter leveled over. A substantial six-board plank fence with redwood base, so constructed as to be rabbit-proof, has been built around the tract, and an "automatic" gate placed at the front entrance. A well has been dug near the site of the dwelling, in which water has been reached at the depth of 95 feet. This is the only well for many miles on the plateau level, and itself demonstrates a fact of considerable importance to the region. The supply is thought to be large, but awaits the putting in of a deep-well pump before it can be definitely gauged.

Plans for the dwelling and outbuildings have been forwarded to Mr. Webster, who will push their construction with his accustomed energy.

3. In the establishment of the *San Joaquin Valley Station* the initiative was taken by Tulare Grange, among whose members Messrs. B. F. Moore and Wm. F. Stewart have been especially active in forwarding the work, serving as a committee whose task alone in accompanying the writer to the numerous locations offered was not light. The selection was difficult on account of the highly specialized character of the soils of the Kaweah delta, within which a location fairly representative of the "plains soils" from Kern to Stanislaus was not easy to find. It is believed, however, that a thoroughly representative tract has been found on the low ridge on which Tulare City is located, about a mile and a half southeast from the town, where Mr. B. F. Moore offered a 20-acre tract, so selected as to include a few acres of "alkali land" (the reclamation of which will form one of the most important problems to be solved), together with the sandy loam with a light hardpan foundation, that scarcely varies in its nature and (outside of the Fresno region)

forms the bulk of the soil of the San Joaquin plains.

A guaranteed subscription of \$3000 toward the cost of the erection of buildings was promptly made by citizens of Tulare City and neighborhood. Plans for these have been forwarded, and their construction, it is understood, will commence immediately.

Irrigation being essential in this region, and ditch-water being uncertain in supply as yet, it was concluded to bore a well, or several if necessary, in order to reach and utilize the abundant water supply which is commonly found here at about 12 feet depth, but which becomes apparently inexhaustible when the gravel stratum lying at 30-50 feet depth is tapped. A ten-inch well has therefore been sunk to the depth of 60 feet, with the usual result of an abundant rise of water to within 12 feet of the surface. A "triple-action" irrigating pump with horse-power has been sent on and will shortly be put up under the superintendence of Mr. B. F. Moore, the donor of the land, who has also rendered most efficient services in overlooking the putting-up of the fence; which is a "six-board," like that at the Coast Range station, and will likewise be provided with an "automatic" gate. Mr. Moore proposes to irrigate and plow the land, as a preparation for the season's work, so soon as the pump and power shall be in position.

Occupation of the Stations.—Considering unavoidable as well as unforeseen delays, it is probable that none of the three stations will be ready for occupation before October 1st. It is, of course, highly desirable that the coming season's work should be laid off and begun at the earliest moment possible, and the selection and training of men competent to serve as foremen in charge has been in progress for several months.

It is perhaps hardly necessary to specify the experimental cultures to be at once initiated at these stations. Roughly speaking, they will come mainly under the following chief heads: Orchard fruits, grape varieties, forage plants, cereals, and other miscellaneous culture plants. In view of the small area of the station

grounds, and of the existence of special stations for that purpose, forest trees will not be experimented on to any large extent.

The Experiment Station Building at Berkeley. In conformity with the recommendation made in Bulletin 78, a handsome and substantial building containing the necessary laboratories, workrooms and offices for the experimental work, has been erected on the University grounds at Berkeley; partly on foundations already existing and used as a viticultural laboratory. The dimensions of this building are 46x92 feet; three brick-walled cellars with concrete floors underlie one-half of the brick basement, which has six workrooms and two storerooms. The superstructure is of wood. The main floor is occupied by the chemical laboratories, a large collection-room (also to be used for the instruction of classes in agriculture and viticulture) and the director's office. The second floor contains offices and workrooms for other than chemical work. Two of these will at once be occupied by the assistant superintendent of the experimental grounds at Berkeley, Mr. E. J. Wickson; while others remain to be occupied hereafter by such needful additions to the working force as will obviously soon be required, among which, a "State Entomologist" is perhaps the most pressing need.

A spacious attic will afford additional storage and workroom for certain purposes when necessary.

The laboratories, collection and workrooms are now being fitted up with the necessary work tables, cases and shelving, partly new and partly transferred from the rooms heretofore occupied elsewhere. A complete "steam apparatus," (steam bath for chemical use—such as digestions, evaporations, etc.,) with connections for steam-drying chamber, distilled water, and other distillations, has been ordered from Germany and is expected to arrive within a month.

It is hoped that the foregoing statements will indicate that the time which has elapsed since appropriations became available under the Hatch Act, has been diligently utilized.

Berkeley, Aug. 29, 1888. E. W. HILGARD.